

**WHAT IS CLAIMED IS:**

- 1           1. An apparatus for forming at least one ring with an undercut or  
2           overhang on a lead battery terminal, the apparatus comprising:  
3                       a fixture configured to securely position the battery terminal;  
4                       a rolling station including a cold metal forming member  
5           configured to transform at least one ring on the battery terminal from having  
6           a first shape into a second different shape with an undercut or overhang  
7           when the battery terminal and cold metal forming member are rotated relative  
8           to each other; and  
9                       a drive assembly configured to rotate the battery terminal and  
10          cold metal forming member relative to each other.
- 1           2.     The apparatus of Claim 1, wherein the first shape of the at least  
2           one ring is a rectangle in cross-section.
- 1           3.     The apparatus of Claim 1, wherein the second shape of the at  
2           least one ring is an arrowhead in cross-section.
- 1           4.     The apparatus of Claim 1, wherein the at least one ring is a pair  
2           of rings.
- 1           5.     The apparatus of Claim 1, wherein the cold metal forming  
2           member includes at least one roller.
- 1           6.     The apparatus of Claim 5, wherein the at least roller is a cam  
2           including an outer circumference having a burnishing portion.
- 1           7.     The apparatus of Claim 5, wherein the at least roller is a cam  
2           including an outer circumference having a shaping portion with at least one  
3           valley including a pair of sidewalls set at an angle of between about 90° to  
4           about 120° relative to each other.

1           8.     The apparatus of Claim 5, wherein the at least one roller  
2     comprises a plurality of rollers spaced equally about an outer surface of the  
3     battery terminal.

1           9.     The apparatus of Claim 8, wherein each of the plurality of rollers  
2     includes an outer circumference having a straight portion.

1           10.    A method for forming at least one ring with an undercut or  
2     overhang on a lead battery terminal, the method comprising:  
3                 securing the battery terminal within a fixture; and  
4                 engaging a cold metal forming member with an outer surface of  
5     the lead battery terminal while the cold metal forming member and the  
6     battery terminal are rotating relative to each other;  
7                 transforming at least one ring on the lead battery terminal from  
8     having a first shape into a second different shape with an undercut or  
9     overhang.

1           11.    The method of Claim 10, wherein the engaging step includes  
2     contacting the outer surface of the battery terminal with at least one roller.

3           12.    The method of Claim 11, wherein the engaging step includes  
4     contacting the outer surface of the battery terminal with a plurality of rollers  
5     positioned at equally spaced locations around the outer surface of the battery  
6     terminal.

1           13.    The method of Claim 12, wherein the plurality of rollers are  
2     configured to revolve about the battery terminal at a first rate of speed while  
3     each roller is configured to rotate about its own axis at a second rate of  
4     speed.

1           14. The method of Claim 13, wherein the transformation step is  
2           accomplished by a single rotation of each of the plurality of rollers about its  
3           own axis.

1           15. The method of Claim 13, wherein the first speed is higher than  
2           the second rate of speed.

1           16. The method of Claim 15, wherein the first rate of speed is  
2           between about 500 to about 600 RPM while the second rate of speed is  
3           between about 20 to about 30 RPM.

1           17. The method of Claim 10, wherein the transforming step is  
2           accomplished without substantially removing any material from the at least  
3           one ring.

1           18. The method of Claim 10, further including the step of cold  
2           pressing the battery terminal from a lead slug into a semi-finished shape  
3           including the annular rings having the first cross-sectional shape prior to the  
4           engaging step.

1           19. The method of Claim 10, wherein the first cross-sectional shape  
2           is a rectangle.

1           20. A method for forming a finished lead alloy battery terminal with  
2           at least one sealing ring having an undercut or overhang, the method  
3           comprising:

4                        securing a partial-finished battery terminal within a fixture, the  
5           partial-finished battery terminal including at least one sealing ring lacking an  
6           undercut or overhang; and

7                   engaging a cold metal forming member with the at least one  
8   sealing ring of the partial-finished battery terminal while the cold metal  
9   forming member and the partial-finished battery terminal are rotating relative  
10   to each other; and

11                   reshaping the at least one sealing ring on the partial-finished  
12   battery terminal into a sealing ring on the finished battery terminal having an  
13   undercut or overhang without substantially removing any material.

1           21.   The method of Claim 20, wherein the reshaping step comprises  
2   radial rolling corners of the at least one sealing ring on the partial-finished  
3   battery terminal to push the lead alloy material outward and backward  
4   towards a base diameter surface of the battery terminal.

1           22.   The method of Claim 21, wherein the radial rolling step produces  
2   a pair of undercuts on the at least one sealing ring with each undercut having  
3   a radius of curvature between about 0.10 and about 0.30 inches.